Spontaneously formed emulsions at water | nitrobenzene interface

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When a nitrobenzene (NB) phase came in quiescent contact with a water phase, both W/O emulsions and O/W emulsions formed spontaneously without any surfactant [1]. The size distributions of both W/O emulsions and O/W emulsions, less than some micrometers in diameter, were determined by dynamic light scattering (DLS). The molar concentrations of NB in the spontaneously separated supernatant and in the centrifuged supernatant were determined by use of UV spectra. The former was 1.7 times as large as the latter, which also suggested the presence of NB droplets. Cycic voltammetries were carried out by use of deliberately dissolved ferrocene (Fc) as a redox probe in the NB-water mixed solutions. The peak potentials of Fc-included NB/water (5:95 vol%) emulsion (0.42, 0.34 V) extrapolated to I = 0 are closer to those of ferrocene in NB (0.47, 0.55 V [2]) than those in water (0.15, 0.23 V). The voltammograms in the ultrasonicated supernatant exhibited diffusion-controlled redox peaks of Fc, which should be supplied from both dissolved Fc and Fc-dissolved NB droplets. The former was one-third of the latter by the comparison with the current of Fc-saturated aqueous solution. The Fc-dissolved NB droplets increased the average concentration of Fc in the mixed solution.

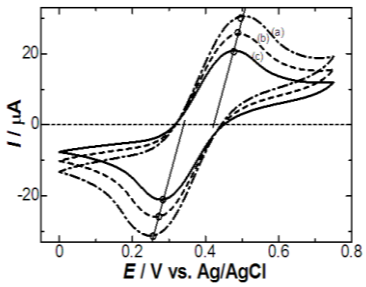

Fig.1 Voltammograms of the O/W emulsion (volume fraction of the NB was 0.05) including saturated ferrocene and 0.4 M $NaClO_4$ in both phases at the glassy carbon electrode 3 mm in diameter at scan rate ν = (a) 80, (b) 50 and (c) 30 mV s^{-1}

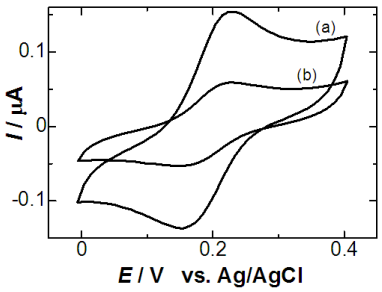

Fig.2 Voltammograms of ferrocene in the centrifuged supernatant of the emulsion including 0.4 M $NaClO_4$ in aqueous phase and 0.4 M TBAP in NB (a) and in ferrocene-saturated water (b) including 0.4 M $NaClO_4$ at the glassy carbon electrode 3 mm in diameter for ν = 30 mV s^{-1}.

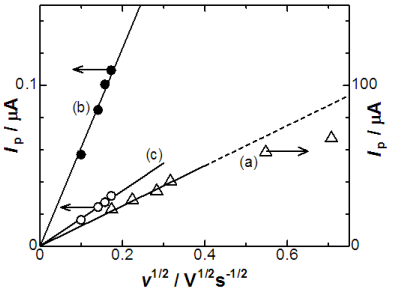

Fig.3 Variations of anodic peak current of saturated ferrocene (a) in the emulsion, (b) in the supernatant, and (c) in water phase against square-roots of the scan rate.

Acknowledgements

This work was financially supported by Grants-in-Aid for Scientific Research (Grants 22550072) from the Ministry of Education in Japan.

References (see example below)

1. M. Li, K. Aoki, J. Chen, T. Nishiumi, *J. Electroanal. Chem.* **655** 159-163 (2011).
2. J. Chen, O. Ikeda, K. Aoki, *J. Electroanal. Chem.* **496** 88-94 (2001).

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